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## Contents

- Agent-based Computing
- Agent-based Software Engineering
- Agent-based Programming Languages
- Agent-based Applications

## Agents

- An autonomous agent is a system situated within and a part of an environment that senses that environment and acts on it, over time, in pursuit of its own agenda and so as to effect what it senses in the future [Franklin and Graesser 1996].

## Agents

- Wooldridge and Jennings [1995]
  - An agent is a hardware or (more usually) software-based computer system that enjoys the following properties:
    - Autonomy
    - Social ability
    - Reactivity (Perceptive)
    - Pro-activeness:

## Agents

- Autonomy
  - Agent operate without the direct intervention of humans or others, and have some kind of control over their actions and internal state.
- Social ability
  - Agents interact with other agents (and possibly humans) via some kind of agent-communication language.

## Agents

- Reactivity (Perceptive)
  - Agents perceive their environment, (which may be the physical world, a user via a GUI, a collection of other agents, the Internet, or perhaps all of these combined), and respond in a timely fashion to changes that occur in it.
- Pro-activeness:
  - Agent do not simply act in response to their environment, they are able to exhibit goal-directed behavior by taking the initiative.

## Properties of Agents [Franklin and Graesser 1996]

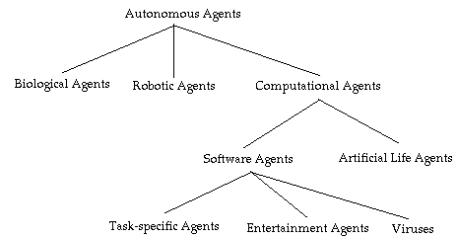
Property	Other Names	Meaning
Reactive	Sensing & acting	Responds in a timely fashion to changes in the environment
Autonomous		Exercises control over its own actions
Goal-oriented	Pro-active Purposeful	Does not simply act in response to the environment
Temporally continuous		Is a continuously running process
Communicative	Socially able	Communicate with other agents, perhaps including people
Learning	Adaptive	Changes its behavior based on its previous experience
Mobile		Able to transport itself from one machine to another
Flexible		Actions are not scripted.
Character		Believable personality and emotional state

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## Classification of Agents

- Excepted from Franklin and Graesser [1996]



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## Classification of Agents

- KidSim Agent [Smith, Cypher, and Sponhrer 1994]
  - Is dedicated to a specific purpose – task-specific agent
- Hayes-Roth Agent [Hayes-Roth 1995]
  - Reasons to interpret perceptions, solve problems, draw inferences, and determine actions – reasoning agent
- IBM Agent [IBM ??]
  - Carries out some set of operations on behalf of a user or another program – task-specific agent

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## Classification of Agents

- Wooldridge & Jennings Agent [Wooldridge & Jennings 1995]
  - Interacts with other agents (and possibly humans) via some kind of agent-communication language – communicative agent
- SodaBot Agent [Cohen 1994]
  - Engages dialog, and negotiates and coordinates transfer of information – negotiating, information agent

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## Classification of Agents

- Julia Agent [Mauldin 1993]
  - Used in MUD (Multiple User Dimension, Multiple User Dungeon, or Multiple User Dialogue), a computer program which users can log into and explore - entertaining agent

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## Classification of Agents

- Petrie [1996] provides a good review of classified agents.

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## Multiagent

- Agents must work cooperatively with other agents in a heterogeneous environment.
- Sycara [1998] lists 6 challenges of multiagent systems:
  - How to decompose problems and allocate tasks to individual agents.
  - How to coordinate agent control and communications.
  - How to make multiple agents act in a coherent manner.
  - How to make individual agents reason about other agents and the state of coordination.
  - How to reconcile conflicting goals between coordinating agents.
  - How to engineer practical multiagent systems.

## Multiagent

- Multiagent Systems Engineering (MaSE) is an attempt to answer how to engineer practical multiagent systems, and to provide a framework for solving multiagent problems [DeLoach 1999].
  - Domain level design
  - Agent level design
  - Component design
  - System design

## Multiagent

- Multiagent Systems Engineering (MaSE) [DeLoach 1999] uses its own agent modeling language.
  - Agent Diagram
  - Communication Hierarchy Diagram
  - Communication Class Diagram
  - Deployment Diagram

## More Agents


- More definitions and examples found in Franklin and Graesser [1996].
- Application examples found in Maes [2003].
- Theory and application for agents found in Wooldridge, M. and Jennings, [June 1995].
- News and information for agents found in the UMBC Agent Web [UMBC 2003].
- Research examples found in the ABE Group, Stanford Univ., [ABE 2003].

## More Agents

- Jo (2001 – 2005)
  - BDI agent-based software modeling techniques
  - BDI agent-based programming languages

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